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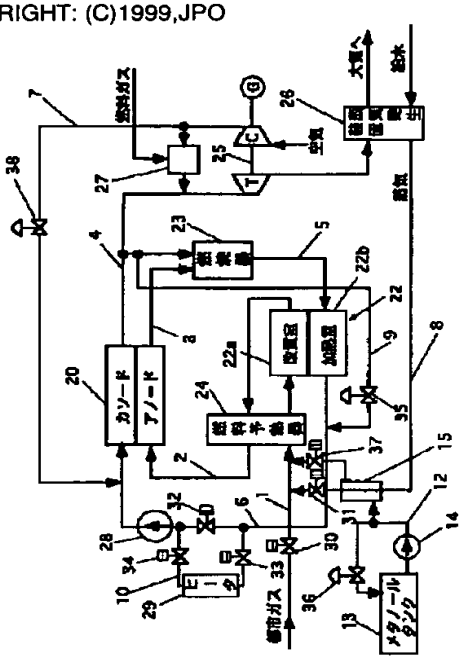
(54) FUEL CELL POWER GENERATING SET WITH METHANOL CRACKER

(57) Abstract:

PROBLEM TO BE SOLVED: To conduct start-up to prevent combustible gas from staying in a piping, an apparatus and a container in a system at the time of start-up.

SOLUTION: A methanol cracker 15 for cracking methanol using steam of a steam line 8 to be supplied to a fuel gas line 1 is provided in a power generating set provided with a fuel cell 20 comprising a cathode and an anode to generate power using cathode gas containing oxygen and anode gas containing hydrogen, a combustor 23 for burning anode exhaust gas discharged from the anode and cathode exhaust gas discharged from the cathode, a reformer 22 for reforming fuel gas containing steam using combustion exhaust gas in the combustor 23 to be supplied to the anode as the anode gas, a carbon dioxide gas recycle line 6 for supplying combustion exhaust gas in the reformer 22 to the cathode, the fuel gas line 1 for supplying fuel gas to the reformer 22, and the steam line 8 for generating steam using the cathode exhaust gas to be supplied to the fuel gas line 1.



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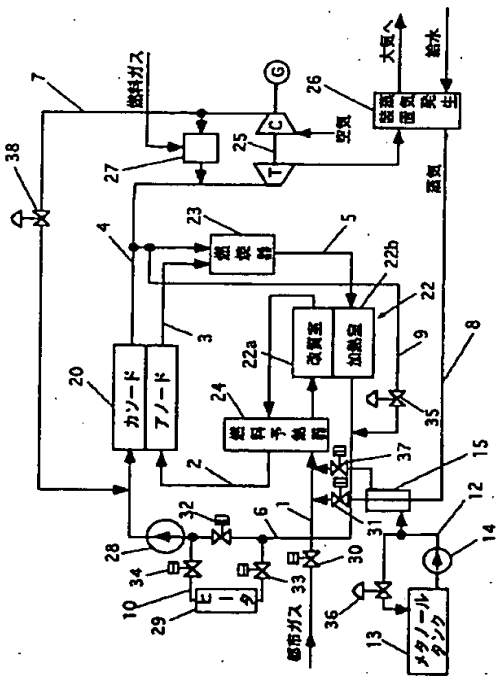
(54)【発明の名称】　メタノール分解装置を備えた燃料電池発電装置

(57)【要約】

【課題】　起動時、可燃性ガスが系統内の配管や機器、容器に溜まらない起動できる燃料電池発電装置を提供する。

【解決手段】　カソードとアノードからなり酸素を含むカソードガスと水素を含むアノードガスから発電する燃料電池２０と、アノードから排出されるアノード排ガスとカソードから排出されるカソード排ガスを燃焼する燃焼器２３と、この燃焼器２３の燃焼排ガスで水蒸気を含む燃料ガスを改質しアノードガスとしてアノードに供給する改質器２２と、この改質器２２の燃焼排ガスをカソードに供給する炭酸ガスリサイクルライン６と、改質器２２に燃料ガスを供給する燃料ガスライン１と、カソード排ガスにより蒸気を発生し燃料ガスライン１に供給する蒸気ライン８と、とを備えた発電装置において、メタノールを蒸気ライン８の蒸気で分解して燃料ガスライン１に供給するメタノール分解装置１５を備える。



【特許請求の範囲】
【請求項１】　カソードとアノードからなり酸素を含むカソードガスと水素を含むアノードガスから発電する燃料電池と、アノードから排出されるアノード排ガスとカソードから排出されるカソード排ガスを燃焼する燃焼器と、この燃焼器の燃焼排ガスで水蒸気を含む燃料ガスを改質しアノードガスとしてアノードに供給する改質器と、この改質器の燃焼排ガスをカソードに供給する炭酸ガスリサイクルラインと、改質器に燃料ガスを供給する燃料ガスラインと、カソード排ガスにより蒸気を発生し燃料ガスラインに供給する蒸気ラインと、とを備えた発電装置において、メタノールを前記蒸気ラインの蒸気で分解して燃料ガスラインに供給するメタノール分解装置を備えたことを特徴とするメタノール分解装置を備えた燃料電池発電装置。
【請求項２】　前記メタノール分解装置として、二重管の内管に蒸気を通し、外管と内管の空間の一部にメタノール分解触媒を充填し残りの空間を蒸発空間とし、メタノールを蒸発空間で蒸発した後メタノール分解触媒を通して水素ガスと一酸化炭素ガスに分解することを特徴とする請求項１記載のメタノール分解装置を備えた燃料電池発電装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、メタノール分解装置を備え、起動時メタノールを燃料として用いる燃料電池発電装置に関する。
【０００２】
【従来の技術】溶融炭酸塩型燃料電池は、高効率で環境への影響が少ないなど、従来の発電装置にない特徴を有しており、水力、火力、原子力に続く発電システムとして注目を集め、現在鋭意研究が進められている。
【０００３】図３は、都市ガスを燃料とする溶融炭酸塩型燃料電池を用いた発電設備の一例を示す図である。図３において、発電設備は、蒸気と混合した燃料ガス（都市ガス）を水素を含むアノードガスに改質する改質器２２と、酸素を含むカソードガスと水素を含むアノードガスとから発電する燃料電池２０とを備えており、改質器２２で作られるアノードガスはアノードガスライン２により燃料電池２０に供給され、燃料電池２０の中でその大部分を消費してアノード排ガスとなり、アノード排ガスライン３より触媒燃焼器２３に入りカソード排ガスとともに燃焼して改質器２２の加熱室２２ｂに供給される。
【０００４】改質器２２の加熱室２２ｂより排出された燃焼排ガスは、炭酸ガスリサイクルライン６によりカソードへ供給される。炭酸ガスリサイクルライン６には加熱ライン１０が設けられ、起動時カソードへ供給する燃焼排ガスの温度を高める。カソード排ガスの一部は触媒燃焼器２３に供給され、他はタービン圧縮機２５に供給され、圧縮空気を発生し、空気ライン７によりカソードに供給される。タービン圧縮機２５からの排気は蒸気発生装置２６に供給され、蒸気を発生し、蒸気ライン８により燃料ガスライン１に供給され、燃料ガスと混合して改質器２２に供給される。タービン圧縮機２５には燃焼器２７が設けられており、圧縮機２５からの空気と燃料ガスを供給され、燃焼ガスをタービン圧縮機２５に供給し、カソード排ガスがない場合でも圧縮空気を発生できるようになっている。
【０００５】燃料電池発電装置起動時は、先ず燃焼器２７に燃料ガスを供給し、燃焼ガスによりタービン圧縮機２５を駆動し、この圧縮機２５の圧縮空気を燃焼器２７に供給して、タービン圧縮機２５を完全に立ち上げ、圧縮空気の供給と、蒸気発生装置による蒸気の供給を可能にする。次に加熱ライン１０のヒータ２９を作動し、カソードに供給するガスの温度を上昇して行く。ここで燃料ガスと蒸気を改質室２２、アノードを介して触媒燃焼器２３に送るとともに、圧縮空気を空気ライン７よりカソードを介して触媒燃焼器２３に送り、燃焼して燃焼排ガスを改質器２２の加熱室２２ｂに送り、改質作用をして、燃焼排ガスを炭酸ガスリサイクルライン６に送り、ヒータ２９で加熱して循環するガスを昇温して行く。かかる操作を繰り返して行くうちに各系統、機器の温度が運転温度に達し、起動が終了し負荷運転に入れるようになる。
【０００６】
【発明が解決しようとする課題】しかし、このような起動方法では、加熱室２２ｂの温度が改質に十分な温度とならない状態で改質が行われるため、改質室２２ａでは十分な改質が行われず、部分的な改質，つまり可燃性ガスではあるが、未燃焼となるガスを含む改質ガスが発生し、この未燃焼となるガスがアノード、触媒燃焼器２３、加熱室２２ｂを通りカソードに流入するため、系統内の配管、機器、容器内に可燃性ガスが溜まり、その濃度が高まってくる。このようなガスが溜まると運転上、および安全上好ましくない。
【０００７】本発明は、上述の問題点に鑑みてなされたもので、起動時、可燃性ガスが系統内の配管や機器、容器に溜まらない起動できる燃料電池発電装置を提供することを目的する。
【０００８】
【課題を解決するための手段】上記目的を達成するため請求項１の発明では、カソードとアノードからなり酸素を含むカソードガスと水素を含むアノードガスから発電する燃料電池と、アノードから排出されるアノード排ガスとカソードから排出されるカソード排ガスを燃焼する燃焼器と、この燃焼器の燃焼排ガスで水蒸気を含む燃料ガスを改質しアノードガスとしてアノードに供給する改質器と、この改質器の燃焼排ガスをカソードに供給する炭酸ガスリサイクルラインと、改質器に燃料ガスを供給

する燃料ガスラインと、カソード排ガスにより蒸気を発生し燃料ガスラインに供給する蒸気ラインと、とを備えた発電装置において、メタノールを前記蒸気ラインの蒸気で分解して燃料ガスラインに供給するメタノール分解装置を備える。

【０００９】起動時、蒸気ラインの蒸気を用いてメタノール分解装置によりメタノールを水素と一酸化炭素に分解し、蒸気と混合して改質器に供給し、改質器、アノードを介して燃焼器に供給する。燃焼器でこれらのガスを十分に燃焼して、改質器の燃焼室に送る。燃焼室はこの燃焼排ガスにより十分加熱されるので、改質器による改質作用が十分に行われるようになる。また燃焼排ガスを炭酸ガスリサイクルラインによりカソードに循環させることにより、通過する系統の配管や機器を加熱してゆく。このようにして関連する系統が運転温度に高まってきたら、メタノールを燃料ガスに切り換える。これにより、可燃性ガスの蓄積を起こすことなく、運転に係わる系統内の温度を高め，負荷運転状態に立ち上げることができる。

【００１０】請求項２の発明では、前記メタノール分解装置として、二重管の内管に蒸気を通し、外管と内管の空間の一部にメタノール分解触媒を充填し残りの空間を蒸発空間とし、メタノールを蒸発空間で蒸発した後メタノール分解触媒を通して水素ガスと一酸化炭素ガスに分解する。

【００１１】内管を通る蒸気により蒸発空間に供給されたメタノールを蒸発させ、これを分解触媒に通すことにより、水素ガスと一酸化炭素ガスに分解することができる。この両ガスは燃焼器で確実に燃焼するので、未燃焼ガスを発生させない。

【００１２】

【発明の実施の形態】以下、本発明の実施形態を図面を参照して説明する。図１は実施形態の燃料電池発電装置の構成を示す図である。発電設備は、蒸気と混合した燃料ガス（都市ガス）を水素を含むアノードガスに改質する改質器２２と、酸素を含むカソードガスと水素を含むアノードガスとから発電する燃料電池２０と、アノード排ガスとカソード排ガスを燃焼し燃焼排ガスを改質器２２に供給し改質反応を行わせる触媒燃焼器２３を備えている。

【００１３】燃料ガスライン１は遮断弁３０を介して燃料予熱器２４に接続され、燃料予熱器２４は改質器２２の改質室２２ａに接続され、改質室２２ａで生成された水素ガスを主成分とするアノードガスと熱交換して都市ガスおよび蒸気ライン８から供給される蒸気を加熱する。燃料予熱器２４で熱交換して冷却されたアノードガスはアノードガスライン２によりアノードに供給される。

【００１４】触媒燃焼器２３にはアノード排ガスライン３から燃焼成分を含むアノード排ガスが供給され、カソード排ガスライン４から酸素を含むカソード排ガスが供給され、燃焼して高温の燃焼排ガスとなり、燃焼排ガスライン５により、加熱室２２ｂへ燃焼排ガスが供給され、改質室２２ａを加熱した後、炭酸ガスリサイクルライン６により、炭酸ガスリサイクルブロワ２８でカソードに供給される。なお、カソード排ガスライン4 から分岐してカソード排ガスバイパスライン９が設けられ、触媒燃焼器２３と加熱室２２ｂをバイパスし、流量制御弁３５を介して炭酸ガスリサイクルライン６に接続して、カソード排ガスをカソードに循環させる。また、炭酸ガスリサイクルライン６には加熱ライン１０が設けられ、起動時カソードに供給するガスをヒータ２９により加熱できるようになっている。

【００１５】カソード排ガスライン４よりタービン圧縮機２５にカソード排ガスが供給され、タービンを駆動し同軸で接続された圧縮機により圧縮空気を生成して、空気ライン７によりカソードに供給する。タービンの排ガスは蒸気発生装置２６に供給され、蒸気を発生し、蒸気ライン８により燃料ガスライン１に供給される。タービン圧縮機２５には燃焼器２７が設けられ、燃料ガスと圧縮空気を供給されて燃焼し、燃焼排ガスをタービンに供給し、起動時のまだカソード排ガスが十分発生しないときタービンを駆動して圧縮空気を生成し，排ガスにより蒸気発生装置２６で蒸気を発生する。

【００１６】メタノール循環ライン１２には、メタノールタンク１３と、ポンプ１４、流量制御弁３６が設けられ、かつメタノール分解器１５に接続している。メタノール分解器１５は、図２に示すように内管１６ａと外管１６ｂからなる二重管で構成され、内管１６ａは蒸気ライン９の配管となっている。内管１６ａと外管１６ｂとの間の空間は底板１７ａと上板１７ｂで密閉空間を構成し、下部空間は蒸発室を構成し、上部空間には分解触媒１８が充填さている。蒸発室には入り口管１９ａが接続され、上部空間の上部には出口管１９ｂが接続されている。

【００１７】かかる構成により蒸発室に入った液体のメタノールは蒸気で加熱されて蒸発し、下記の反応式により分解触媒でH_2，ＣＯガスに分解される。

$CH_3OH \rightarrow 2H_2 + CO - 90.89KJ$

この際蒸気の温度は３００～４００℃でメタノールを２００～３００℃に加熱する。分解触媒として、ニッケル系触媒または白金系触媒を用いる。発生するH_2，ＣＯガスの温度は２００～３００℃であり、通過する系統の配管、機器にカーボン析出を生じない。なお、このガス温度が５００℃以上となるとカーボン析出が発生する。

【００１８】次に本燃料電池発電装置の起動について説明する。燃料電池２０、改質器２２、触媒燃焼器２３を含む系統には窒素ガスが充填されている。遮断弁３２を閉とし、遮断弁３３、３４を開として加熱ライン１０を接続し、ヒータ２９を稼働させ炭酸ガスリサイクルブロ

ワ２８で窒素ガスを循環させ、触媒燃焼器２３を３００℃程度に加熱しておく。さらに燃焼器２７に燃料ガスを供給して燃焼ガスを発生させ、タービン圧縮機２５を駆動して圧縮空気を発生させ、燃焼器２７に供給する。また、タービン排ガスにより蒸気発生装置２６で蒸気を発生させ、メタノール分解器１５に送り込む。これとともにメタノール循環ライン１２のポンプ１４を駆動し、メタノールをメタノール分解器１５に送り、H_2，ＣＯガスを発生させ、蒸気ライン８からの蒸気とともに改質室２２ａに送り、燃料予熱器２４、アノードを介して触媒燃焼器２３へ送り込む。

【００１９】触媒燃焼器２３ではこれらのガスを空気ライン７の流量制御弁３８とカソードを介して供給される空気で燃焼し、燃焼排ガスを加熱室２２ｂへ送り改質室２２ａでの改質反応を開始する。かかる動作を持続すると各系統の温度も運転温度まで上昇し、窒素ガスもH_2，ＣＯガスや燃焼排ガスに置換され運転状態になってゆく。この状態で遮断弁３２を開とし、遮断弁３３、３４を閉として加熱ライン１０を切り離す。またこの時までにカソード排ガスも増加してくるので、燃焼器２７を停止し、カソード排ガスによりタービン圧縮機２５を駆動する。次に、遮断弁３０を開とし、ポンプ１４を停止し、遮断弁３７を閉として燃料ガスによる運転に入る。これにより起動が終わり、負荷運転に入れる状態になる。

【００２０】上述の動作において、改質室２２ａが十分な高温にならない期間はメタノールの分解ガスが供給され、触媒燃焼器２３で確実に燃焼するので、この触媒燃焼器２３に接続する系統内に可燃ガスが滞留することがなくなり、運転上支障がなく、かつ安全性も確保される。

【００２１】

【発明の効果】以上の説明より明らかなように、本発明は、起動時、燃料ガスに代えてメタノール分解ガスを用いることにより、系統内に可燃性ガスが滞留するのを防止するので、可燃性ガス滞留による運転上の支障がなく、安全性も確保することができる。

【図面の簡単な説明】

【図１】本発明の実施形態の構成を示す図である。

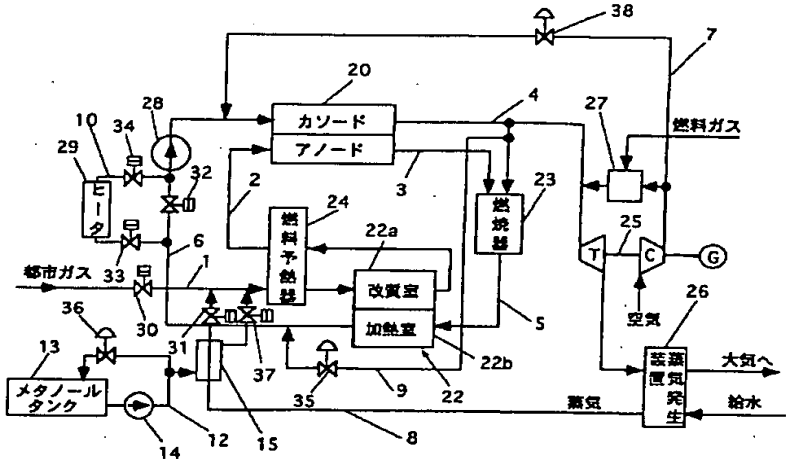
【図２】メタノール分解器の構成を示す。

【図３】従来の燃料電池発電装置の構成を示す図である。

【符号の説明】

１　燃料ガスライン
２　アノードガスライン
３　アノード排ガスライン
４　カソード排ガスライン
５　燃焼排ガスライン
６　炭酸ガスリサイクルライン
７　空気ライン
８　蒸気ライン
９　カソード排ガスバイパスライン
１０　加熱ライン
１２　メタノール循環ライン
１３　メタノールタンク
１４　ポンプ
１５　メタノール分解器
１６ａ　内管
１６ｂ　外管
１７ａ　底板
１７ｂ　上板
１８　分解触媒
１９ａ　入り口管
１９ｂ　出口管
２０　燃料電池
２２　改質器
２２ａ　改質室
２２ｂ　加熱室
２３　触媒燃焼室
２４　燃料予熱器
２５　タービン圧縮機
２６　蒸気発生装置
２７　燃焼器
２８　炭酸ガスリサイクルブロワ
２９　ヒータ
３０，３１，３２，３３，３４，３７　遮断弁
３５、３６、３８　流量制御弁

【図１】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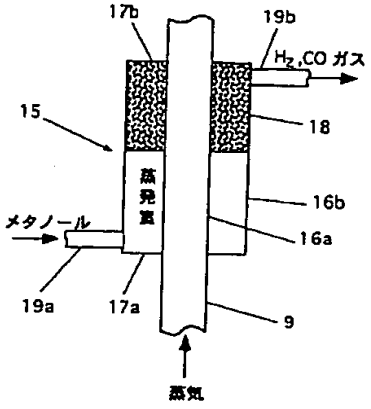
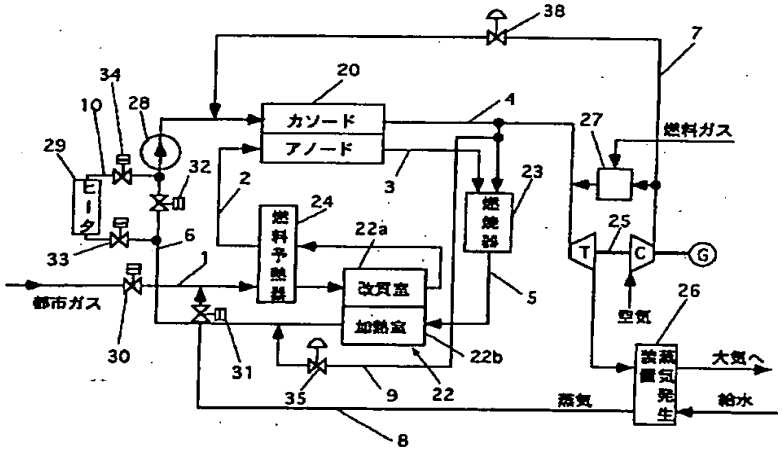
7
20
カソード
アノード
4
27
燃料ガス
10
34
28
29
ヒータ
32
2
3
23
燃焼器
24
燃料予熱器
22a
25
T
C
G
6
1
都市ガス
33
30
改質室
加熱室
5
空気
26
36
31
37
22b
13
35
9
22
装置蒸気発生
大気へ
給水
メタノールタンク
蒸気
14
12
15
8

【図２】


17b
19b
H_2,CO ガス
15
18
蒸発室
16b
メタノール
16a
19a
17a
9
蒸気

【図３】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7
34
20
カソード
アノード
4
27
燃料ガス
10
28
29
ヒータ
32
2
3
23
燃焼器
24
燃料予熱器
22a
25
T
C
G
6
33
1
都市ガス
30
改質室
加熱室
5
空気
26
31
22b
35
9
22
装置蒸気発生
大気へ
給水
蒸気
8

JP 11[redacted]44

* NOTICES *

PRIOR ART

[Description of the Prior Art] That a fused carbonate fuel cell is efficient and has little influence on environment etc. has the feature it is featureless to the conventional power plant, attention is attracted as a power generation system following hydraulic power, fire power, and atomic power, and research is advanced wholeheartedly now.
[0003] Drawing 3 is drawing showing an example of the power generation facility using the fused carbonate fuel cell which uses town gas as fuel. The reforming machine 22 which reforms the fuel gas (town gas) which mixed the power generation facility with the steam to the anode gas containing hydrogen in drawing 3 , It has the fuel cell 20 generated from the cathode gas containing oxygen, and the anode gas containing hydrogen. The anode gas made with the reforming vessel 22 is supplied to a fuel cell 20 by the anode gas line 2. The most is consumed in a fuel cell 20, and it becomes anode exhaust gas, and from the anode exhaust gas line 3, it goes into the catalyzed-combustion machine 23, it burns with cathode exhaust gas, and heat-chamber 22b of the reforming machine 22 is supplied.
[0004] The combustion gas discharged from heat-chamber 22b of the reforming machine 22 is supplied to a cathode by the carbon-dioxide-gas recycling line 6. The heating line 10 is formed in the carbon-dioxide-gas recycling line 6, and the temperature of the combustion gas supplied to a during-starting cathode is raised. A part of cathode exhaust gas is supplied to the catalyzed-combustion machine 23, and others are supplied to the turbine compressor 25, they generate the compressed air and are supplied to a cathode by the air line 7. The exhaust air from the turbine compressor 25 is supplied to a steam generator 26, generates a steam, is supplied to the fuel gas line 1 by the steamy line 8, is mixed with fuel gas and supplied to the reforming machine 22. The combustor 27 is formed in the turbine compressor 25, the air and fuel gas from a compressor 25 are supplied, combustion gas is supplied to the turbine compressor 25, and the compressed air can be generated even when there is no cathode exhaust gas.
[0005] Fuel cell power-plant during starting supplies fuel gas to a combustor 27 first, drives the turbine compressor 25 by combustion gas, supplies the compressed air of this compressor 25 to a combustor 27, starts the turbine compressor 25 completely, and enables supply of the compressed air, and supply of the steam by the steam generator. Next, it goes up and goes the temperature of the gas which operates and supplies the heater 29 of the heating line 10 to a cathode. While sending fuel gas and a steam to the catalyzed-combustion machine 23 through the reforming room 22 and an anode here, the compressed air is sent to the catalyzed-combustion machine 23 through a cathode from the air line 7, and it burns, a combustion gas is sent to heat-chamber 22b of the reforming machine 22, a reforming operation is carried out, and a combustion gas is sent to the carbon-dioxide-gas recycling line 6, and at a heater 29, the temperature up of the gas which heats and circulates is carried out, and it goes. While repeating this operation and going, the temperature of each system and a device reaches an operating temperature, starting is completed, and it comes to put into load operation.

[Translation done.]

MEANS

[Means for Solving the Problem] In order to attain the above-mentioned purpose in invention of a claim 1 The fuel cell generated from the cathode gas which consists of a cathode and an anode and contains oxygen, and the anode gas containing hydrogen, The combustor which burns the anode exhaust gas discharged from an anode, and the cathode exhaust gas discharged from a cathode, The reforming machine which reforms the fuel gas which contains a steam by the combustion gas of this combustor, and is supplied to an anode as anode gas, The carbon-dioxide-gas recycling line which supplies the combustion gas of this reforming machine to a cathode, In the fuel gas line which supplies fuel gas to a reforming machine, the steamy line which generates a steam by cathode exhaust gas and is supplied to a fuel gas line, and the power plant equipped with **, it has methanolysis equipment which disassembles a methanol with the steam of the aforementioned steamy line, and is supplied to a fuel gas line.

[0009] Methanolysis equipment decomposes a methanol into hydrogen and a carbon monoxide using the steam of during starting and a steamy line, it mixes with a steam, a reforming machine is supplied, and a combustor is supplied through a reforming machine and an anode. These gas is fully burned with a combustor and it sends to the combustion chamber of a reforming machine. Since a combustion chamber is enough heated by this combustion gas, the reforming operation with a reforming machine fully comes to be performed. Moreover, piping and the device of a system to pass are heated by making a cathode circulate through a combustion gas by the carbon-dioxide-gas recycling line. Thus, if a related system increases in an operating temperature, a methanol will be switched to fuel gas. Thereby, without causing accumulation of inflammable gas, the temperature in the system concerning operation can be raised and it can rise to load operational status.

[0010] In invention of a claim 2, as the aforementioned methanolysis equipment, the inner tube of a double pipe is filled up with a steam, a part of space of through, an outer tube, and an inner tube is filled up with a methanolysis catalyst, and the remaining space is made into evaporation space, and after evaporating a methanol in evaporation space, it decomposes into hydrogen gas and carbon monoxide gas through a methanolysis catalyst.

[0011] It can decompose into hydrogen gas and carbon monoxide gas by evaporating the methanol supplied to evaporation space by the steam which passes along an inner tube, and letting this pass for a decomposition catalyst. Since both this gas burns certainly with a combustor, unburnt glow gas is not generated.

[0012]

[Embodiments of the Invention] Hereafter, the operation gestalt of this invention is explained with reference to a drawing. Drawing 1 is drawing showing the composition of the fuel cell power plant of an operation gestalt. The power generation facility is equipped with the catalyzed-combustion machine 23 in which burn the fuel cell 20 generated from the reforming machine 22 which reforms the fuel gas (town gas) mixed with the steam to the anode gas containing hydrogen, the cathode gas containing oxygen, and the anode gas containing hydrogen, and anode exhaust gas and cathode exhaust gas, supply a combustion gas to the reforming machine 22, and a reforming reaction is made to perform.

[0013] It connects with the fuel preheater 24 through an isolation valve 30, and the fuel preheater 24 is connected to reforming room 22a of the reforming machine 22, and the fuel gas line 1 heats the steam which carries out a heat exchange to the anode gas which makes a principal component the hydrogen gas generated by reforming room 22a, and is supplied from town gas and the steamy line 8. The anode gas cooled by carrying out a heat exchange with the fuel preheater 24 is supplied to an anode by the anode gas line 2.

[0014] After the anode exhaust gas which contains a combustion component in the catalyzed-combustion machine 23 from the anode exhaust gas line 3 is supplied, the cathode exhaust gas which contains oxygen from the cathode exhaust gas line 4 is supplied, and burning, becoming a hot combustion gas, and a combustion gas's being supplied to heat-chamber 22b by the combustion-gas line 5 and heating reforming room 22a, a cathode is supplied by the carbon-dioxide-gas recycling line 6 by the carbon-dioxide-gas recycling blower 28. In addition, cathode exhaust gas line 4 Shell branching is carried out, the cathode exhaust gas pie pass line 9 is formed, the catalyzed-combustion machine 23 and heat-chamber 22b are bypassed, it connects with the carbon-dioxide-gas recycling line 6 through a flow control valve 35, and a cathode is made to circulate through cathode exhaust gas. Moreover, the heating line 10 is formed in the carbon-dioxide-gas recycling line 6, and the gas supplied to a during-starting cathode can be heated now at a heater 29.

[0015] Cathode exhaust gas is supplied to the turbine compressor 25 from the cathode exhaust gas line 4, the compressor which drove the turbine and was connected on the same axle generates the compressed air, and a cathode is supplied by the air line 7. The exhaust gas of a turbine is supplied to a steam generator 26, generates a steam and is supplied to the fuel gas line 1 by the steamy line 8. A combustor 27 is formed in the turbine compressor 25, and fuel gas and the compressed air are

supplied, it burns, and a combustion gas is supplied to a turbine, when [of during starting] cathode exhaust gas does not occur enough yet, a turbine is driven, the compressed air is generated, and a steam is generated in a steam generator 26 by exhaust gas.

[0016] The methanol tank 13, and a pump 14 and a flow control valve 36 were prepared in the methanol circulation line 12, and it has connected with the methanolysis machine 15. The methanolysis machine 15 consists of double pipes which consist of inner-tube 16a and outer-tube 16b, as shown in drawing 2 , and inner-tube 16a has become piping of the steamy line 9. the space between inner-tube 16a and outer-tube 16b -- bottom plate 17a and finish plate 17b -- a closed space -- constituting -- lower space -- an evaporation chamber -- constituting -- up space -- the decomposition catalyst 18 -- restoration -- now, it is Entrance pipe 19a is connected to an evaporation chamber, and outlet-pipe 19b is connected to the upper part of up space.

[0017] The methanol of the liquid which went into the evaporation chamber by this composition is heated with a steam, evaporates, and is disassembled into H2 and CO gas by the following reaction formula with a decomposition catalyst.

CH3 OH->2H2+CO- steamy temperature heats a methanol at 200-300 degrees C at 300-400 degrees C 90.89 KJ in this case As a decomposition catalyst, a nickel system catalyst or a platinum system catalyst is used. The temperature of occurring H2 and CO gas is 200-300 degrees C, and does not produce a carbon deposit to piping of the passing system, and a device. In addition, if this gas temperature becomes 500 degrees C or more, a carbon deposit will occur.

[0018] Next, starting of this fuel cell power plant is explained. The system containing a fuel cell 20, the reforming machine 22, and the catalyzed-combustion machine 23 is filled up with nitrogen gas. An isolation valve 32 is made close, the heating line 10 is connected by making isolation valves 33 and 34 open, a heater 29 is worked, nitrogen gas is circulated by the carbon-dioxide-gas recycling blower 28, and the catalyzed-combustion machine 23 is heated at about 300 degrees C. Furthermore, fuel gas is supplied to a combustor 27, combustion gas is generated, the turbine compressor 25 is driven, the compressed air is generated, and a combustor 27 is supplied. Moreover, a steam is generated in a steam generator 26 by turbine exhaust gas, and it sends into the methanolysis machine 15. The pump 14 of the methanol circulation line 12 is driven with this, and a methanol is sent to the methanolysis machine 15, and H2 and CO gas are generated, and it sends to reforming room 22a with the steam from the steamy line 8, and sends into the catalyzed-combustion machine 23 through the fuel preheater 24 and an anode.

[0019] With the catalyzed-combustion vessel 23, it burns with the air to which these gas is supplied through the flow control valve 38 and cathode of the air line 7, a combustion gas is sent to heat-chamber 22b, and the reforming reaction in reforming room 22a is started. If this operation is maintained, the temperature of each system will also rise to an operating temperature, will be replaced by nitrogen gas H2, CO gas, or the combustion gas, and will be in operational status. An isolation valve 32 is made open in this state, and the heating line 10 is separated by making isolation valves 33 and 34 close. Moreover, since cathode exhaust gas will also increase by this time, a combustor 27 is suspended and the turbine compressor 25 is driven by cathode exhaust gas. Next, an isolation valve 30 is made open, and a pump 14 is suspended and it goes into operation by fuel gas by making an isolation valve 37 close. Starting finishes by this and it will be in the state of putting into load operation.

[0020] In above-mentioned operation, since the cracked gas of a methanol is supplied and the period when reforming room 22a does not become sufficient elevated temperature burns certainly with the catalyzed-combustion vessel 23, it is lost that combustible gas piles up in the system linked to this catalyzed-combustion machine 23, and there is no operation top trouble, and safety is also secured.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the composition of the operation gestalt of this invention.
[Drawing 2] The composition of a methanolysis machine is shown.
[Drawing 3] It is drawing showing the composition of the conventional fuel cell power plant.
[Description of Notations]
1 Fuel Gas Line
2 Anode Gas Line
3 Anode Exhaust Gas Line
4 Cathode Exhaust Gas Line
5 Combustion-Gas Line
6 Carbon-Dioxide-Gas Recycling Line
7 Air Line
8 Steamy Line
9 Cathode Exhaust Gas Bypass Line
10 Heating Line
12 Methanol Circulation Line
13 Methanol Tank
14 Pump
15 Methanolysis Machine
16a Inner tube
16b Outer tube
17a Bottom plate
17b Finish plate
18 Decomposition Catalyst
19a Entrance pipe
19b Outlet pipe
20 Fuel Cell
22 Reforming Machine
22a Reforming room
22b Heat chamber
23 Catalyzed-Combustion Room
24 Fuel Preheater
25 Turbine Compressor
26 Steam Generator
27 Combustor
28 Carbon-Dioxide-Gas Recycling Blower
29 Heater
30, 31, 32, 33, 34, 37 Isolation valve
35, 36, 38 Flow control valve

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention is equipped with methanolysis equipment and relates to the fuel cell power plant using a during-starting methanol as fuel.
[0002]
[Description of the Prior Art] That a fused carbonate fuel cell is efficient and has little influence on environment etc. has the feature it is featureless to the conventional power plant, attention is attracted as a power generation system following hydraulic power, fire power, and atomic power, and research is advanced wholeheartedly now.
[0003] Drawing 3 is drawing showing an example of the power generation facility using the fused carbonate fuel cell which uses town gas as fuel. The reforming machine 22 which reforms the fuel gas (town gas) which mixed the power generation facility with the steam to the anode gas containing hydrogen in drawing 3 , It has the fuel cell 20 generated from the cathode gas containing oxygen, and the anode gas containing hydrogen. The anode gas made with the reforming vessel 22 is supplied to a fuel cell 20 by the anode gas line 2. The most is consumed in a fuel cell 20, and it becomes anode exhaust gas, and from the anode exhaust gas line 3, it goes into the catalyzed-combustion machine 23, it burns with cathode exhaust gas, and heat-chamber 22b of the reforming machine 22 is supplied.
[0004] The combustion gas discharged from heat-chamber 22b of the reforming machine 22 is supplied to a cathode by the carbon-dioxide-gas recycling line 6. The heating line 10 is formed in the carbon-dioxide-gas recycling line 6, and the temperature of the combustion gas supplied to a during-starting cathode is raised. A part of cathode exhaust gas is supplied to the catalyzed-combustion machine 23, and others are supplied to the turbine compressor 25, they generate the compressed air and are supplied to a cathode by the air line 7. The exhaust air from the turbine compressor 25 is supplied to a steam generator 26, generates a steam, is supplied to the fuel gas line 1 by the steamy line 8, is mixed with fuel gas and supplied to the reforming machine 22. The combustor 27 is formed in the turbine compressor 25, the air and fuel gas from a compressor 25 are supplied, combustion gas is supplied to the turbine compressor 25, and the compressed air can be generated even when there is no cathode exhaust gas.
[0005] Fuel cell power-plant during starting supplies fuel gas to a combustor 27 first, drives the turbine compressor 25 by combustion gas, supplies the compressed air of this compressor 25 to a combustor 27, starts the turbine compressor 25 completely, and enables supply of the compressed air, and supply of the steam by the steam generator. Next, it goes up and goes the temperature of the gas which operates and supplies the heater 29 of the heating line 10 to a cathode. While sending fuel gas and a steam to the catalyzed-combustion machine 23 through the reforming room 22 and an anode here, the compressed air is sent to the catalyzed-combustion machine 23 through a cathode from the air line 7, and it burns, a combustion gas is sent to heat-chamber 22b of the reforming machine 22, a reforming operation is carried out, and a combustion gas is sent to the carbon-dioxide-gas recycling line 6, and at a heater 29, the temperature up of the gas which heats and circulates is carried out, and it goes. While repeating this operation and going, the temperature of each system and a device reaches an operating temperature, starting is completed, and it comes to put into load operation.
[0006]
[Problem(s) to be Solved by the Invention] However, since reforming is performed in the state where the temperature of heat-chamber 22b does not turn into sufficient temperature for reforming by such starting method, although reforming sufficient in reforming room 22a is not performed but it is partial reforming, i.e., inflammable gas The reformed gas containing the gas which is un-burning is generated, since the gas which is this un-burning flows into a cathode through an anode, the catalyzed-combustion machine 23, and heat-chamber 22b, inflammable gas collects in piping in a system, a device, and a container, and the concentration increases. If such gas collects, it is not desirable on safe on operation.
[0007] this invention was not made in view of the above-mentioned trouble, and during starting and inflammable gas carry out the purpose of offering the fuel cell power plant with which piping in a system, a device, and a container are not covered and which can be started.
[0008]
[Means for Solving the Problem] In order to attain the above-mentioned purpose in invention of a claim 1 The fuel cell generated from the cathode gas which consists of a cathode and an anode and contains oxygen, and the anode gas containing hydrogen, The combustor which burns the anode exhaust gas discharged from an anode, and the cathode exhaust gas discharged from a cathode, The reforming machine which reforms the fuel gas which contains a steam by the combustion gas

of this combustor, and is supplied to an anode as anode gas, The carbon-dioxide-gas recycling line which supplies the combustion gas of this reforming machine to a cathode, In the fuel gas line which supplies fuel gas to a reforming machine, the steamy line which generates a steam by cathode exhaust gas and is supplied to a fuel gas line, and the power plant equipped with **, it has methanolysis equipment which disassembles a methanol with the steam of the aforementioned steamy line, and is supplied to a fuel gas line.

[0009] Methanolysis equipment decomposes a methanol into hydrogen and a carbon monoxide using the steam of during starting and a steamy line, it mixes with a steam, a reforming machine is supplied, and a combustor is supplied through a reforming machine and an anode. These gas is fully burned with a combustor and it sends to the combustion chamber of a reforming machine. Since a combustion chamber is enough heated by this combustion gas, the reforming operation with a reforming machine fully comes to be performed. Moreover, piping and the device of a system to pass are heated by making a cathode circulate through a combustion gas by the carbon-dioxide-gas recycling line. Thus, if a related system increases in an operating temperature, a methanol will be switched to fuel gas. Thereby, without causing accumulation of inflammable gas, the temperature in the system concerning operation can be raised and it can rise to load operational status.

[0010] In invention of a claim 2, as the aforementioned methanolysis equipment, the inner tube of a double pipe is filled up with a steam, a part of space of through, an outer tube, and an inner tube is filled up with a methanolysis catalyst, and the remaining space is made into evaporation space, and after evaporating a methanol in evaporation space, it decomposes into hydrogen gas and carbon monoxide gas through a methanolysis catalyst.

[0011] It can decompose into hydrogen gas and carbon monoxide gas by evaporating the methanol supplied to evaporation space by the steam which passes along an inner tube, and letting this pass for a decomposition catalyst. Since both this gas burns certainly with a combustor, unburnt glow gas is not generated.

[0012]

[Embodiments of the Invention] Hereafter, the operation gestalt of this invention is explained with reference to a drawing. Drawing 1 is drawing showing the composition of the fuel cell power plant of an operation gestalt. The power generation facility is equipped with the catalyzed-combustion machine 23 in which burn the fuel cell 20 generated from the reforming machine 22 which reforms the fuel gas (town gas) mixed with the steam to the anode gas containing hydrogen, the cathode gas containing oxygen, and the anode gas containing hydrogen, and anode exhaust gas and cathode exhaust gas, supply a combustion gas to the reforming machine 22, and a reforming reaction is made to perform.

[0013] It connects with the fuel preheater 24 through an isolation valve 30, and the fuel preheater 24 is connected to reforming room 22a of the reforming machine 22, and the fuel gas line 1 heats the steam which carries out a heat exchange to the anode gas which makes a principal component the hydrogen gas generated by reforming room 22a, and is supplied from town gas and the steamy line 8. The anode gas cooled by carrying out a heat exchange with the fuel preheater 24 is supplied to an anode by the anode gas line 2.

[0014] After the anode exhaust gas which contains a combustion component in the catalyzed-combustion machine 23 from the anode exhaust gas line 3 is supplied, the cathode exhaust gas which contains oxygen from the cathode exhaust gas line 4 is supplied, and burning, becoming a hot combustion gas, and a combustion gas's being supplied to heat-chamber 22b by the combustion-gas line 5 and heating reforming room 22a, a cathode is supplied by the carbon-dioxide-gas recycling line 6 by the carbon-dioxide-gas recycling blower 28. In addition, cathode exhaust gas line 4 Shell branching is carried out, the cathode exhaust gas pie pass line 9 is formed, the catalyzed-combustion machine 23 and heat-chamber 22b are bypassed, it connects with the carbon-dioxide-gas recycling line 6 through a flow control valve 35, and a cathode is made to circulate through cathode exhaust gas. Moreover, the heating line 10 is formed in the carbon-dioxide-gas recycling line 6, and the gas supplied to a during-starting cathode can be heated now at a heater 29.

[0015] Cathode exhaust gas is supplied to the turbine compressor 25 from the cathode exhaust gas line 4, the compressor which drove the turbine and was connected on the same axle generates the compressed air, and a cathode is supplied by the air line 7. The exhaust gas of a turbine is supplied to a steam generator 26, generates a steam and is supplied to the fuel gas line 1 by the steamy line 8. A combustor 27 is formed in the turbine compressor 25, and fuel gas and the compressed air are supplied, it burns, and a combustion gas is supplied to a turbine, when [of during starting] cathode exhaust gas does not occur enough yet, a turbine is driven, the compressed air is generated, and a steam is generated in a steam generator 26 by exhaust gas.

[0016] The methanol tank 13, and a pump 14 and a flow control valve 36 were prepared in the methanol circulation line 12, and it has connected with the methanolysis machine 15. The methanolysis machine 15 consists of double pipes which consist of inner-tube 16a and outer-tube 16b, as shown in drawing 2 , and inner-tube 16a has become piping of the steamy line 9. the space between inner-tube 16a and outer-tube 16b -- bottom plate 17a and finish plate 17b -- a closed space -- constituting -- lower space -- an evaporation chamber -- constituting -- up space -- the decomposition catalyst 18 -- restoration -- now, it is Entrance pipe 19a is connected to an evaporation chamber, and outlet-pipe 19b is connected to the upper part of up space.

[0017] The methanol of the liquid which went into the evaporation chamber by this composition is heated with a steam, evaporates, and is disassembled into H2 and CO gas by the following reaction formula with a decomposition catalyst.

CH3 OH->2H2+CO- steamy temperature heats a methanol at 200-300 degrees C at 300-400 degrees C 90.89 KJ in this case As a decomposition catalyst, a nickel system catalyst or a platinum system catalyst is used. The temperature of occurring H2 and CO gas is 200-300 degrees C, and does not produce a carbon deposit to piping of the passing system, and a device. In addition, if this gas temperature becomes 500 degrees C or more, a carbon deposit will occur.

[0018] Next, starting of this fuel cell power plant is explained. The system containing a fuel cell 20, the reforming machine

22, and the catalyzed-combustion machine 23 is filled up with nitrogen gas. An isolation valve 32 is made close, the heating line 10 is connected by making isolation valves 33 and 34 open, a heater 29 is worked, nitrogen gas is circulated by the carbon-dioxide-gas recycling blower 28, and the catalyzed-combustion machine 23 is heated at about 300 degrees C. Furthermore, fuel gas is supplied to a combustor 27, combustion gas is generated, the turbine compressor 25 is driven, the compressed air is generated, and a combustor 27 is supplied. Moreover, a steam is generated in a steam generator 26 by turbine exhaust gas, and it sends into the methanolysis machine 15. The pump 14 of the methanol circulation line 12 is driven with this, and a methanol is sent to the methanolysis machine 15, and H2 and CO gas are generated, and it sends to reforming room 22a with the steam from the steamy line 8, and sends into the catalyzed-combustion machine 23 through the fuel preheater 24 and an anode.

[0019] With the catalyzed-combustion vessel 23, it burns with the air to which these gas is supplied through the flow control valve 38 and cathode of the air line 7, a combustion gas is sent to heat-chamber 22b, and the reforming reaction in reforming room 22a is started. If this operation is maintained, the temperature of each system will also rise to an operating temperature, will be replaced by nitrogen gas H2, CO gas, or the combustion gas, and will be in operational status. An isolation valve 32 is made open in this state, and the heating line 10 is separated by making isolation valves 33 and 34 close. Moreover, since cathode exhaust gas will also increase by this time, a combustor 27 is suspended and the turbine compressor 25 is driven by cathode exhaust gas. Next, an isolation valve 30 is made open, and a pump 14 is suspended and it goes into operation by fuel gas by making an isolation valve 37 close. Starting finishes by this and it will be in the state of putting into load operation.

[0020] In above-mentioned operation, since the cracked gas of a methanol is supplied and the period when reforming room 22a does not become sufficient elevated temperature burns certainly with the catalyzed-combustion vessel 23, it is lost that combustible gas piles up in the system linked to this catalyzed-combustion machine 23, and there is no operation top trouble, and safety is also secured.

[0021]

[Effect of the Invention] Since this invention prevents that inflammable gas piles up in a system by replacing with during starting and fuel gas and using methanolysis gas, it does not have the trouble on operation by inflammable-gas stay, and safety can also secure it, so that more clearly than the above explanation.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The fuel cell power plant equipped with the methanolysis equipment characterized by having methanolysis equipment which is characterized by providing the following, and which disassembles a methanol with the steam of the aforementioned steamy line, and is supplied to a fuel gas line in a power plant The fuel cell generated from the cathode gas which consists of a cathode and an anode and contains oxygen, and the anode gas containing hydrogen The combustor which burns the anode exhaust gas discharged from an anode, and the cathode exhaust gas discharged from a cathode The reforming machine which reforms the fuel gas which contains a steam by the combustion gas of this combustor, and is supplied to an anode as anode gas the carbon-dioxide-gas recycling line which supplies the combustion gas of this reforming machine to a cathode, the fuel gas line which supplies fuel gas to a reforming machine, and the steamy line which generates a steam by cathode exhaust gas and is supplied to a fuel gas line -- **
[Claim 2] The fuel cell power plant equipped with the methanolysis equipment according to claim 1 which fills up the inner tube of a double pipe with a steam, fills up a part of space of through, an outer tube, and an inner tube with a methanolysis catalyst, makes the remaining space evaporation space as the aforementioned methanolysis equipment, and is characterized by decomposing into hydrogen gas and carbon monoxide gas through a methanolysis catalyst after evaporating a methanol in evaporation space.

[Translation done.]